A Novel, Cost-Effective, and Accessible 3D Printed Thrombectomy Device

Alsowyan, Nasser (School: Unaizah International School)

An estimated 100,000 deaths are caused by blood clots in the United States annually, higher than those by breast cancer and motor crashes combined. One common treatment option involves physically removing unwanted clots to restore blood flow. However, stent-related complications include restenosis, clot breakage, and injury to the point of entry or vessel. To address these issues, biomedical engineers and scientists have been gradually uncovering the potential of 3D-printed thrombectomy devices. This research aims to improve current stent technology and mechanisms, utilizing an inner and outer sent supported by a guide wire designed to penetrate, attach, and discard the thrombus in various arteries and veins. This will be developed alongside two balloons aiding in placement and clot-fragmentation barrier. The components used were designed through NX CAD and intensive research of anthropometric data was conducted to alleviate the current design limitations and allow flexibility. Through LIVE/DEAD™ viability assay, the device demonstrated prominent proliferation on the outer stent, proving biocompatibility. Moreover, a computational load testing simulation was performed in Ansys Mechanical, as well as a fluid flow analysis in COMSOL Multiphysics. Minimal stress and strain of approximately 10% it's yield point and no major blood flow speed drop-offs demonstrated that the guide wire and stents have the strength needed to withstand the applicational force and maintain seamless blood flow through it. The surgical device offers the potential to alleviate the burden of blood clots on global healthcare to safeguard countless lives worldwide.

Awards Won:
Fourth Award of $500